Managing Grain Quality from the Combine

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Introduction:

When and where do farmers realise the value in their crop? When they sell it. However farmers are generally price takers rather than price makers. The price for their crops is determined by a very complex market that includes futures exchanges and government subsidies. Farmers can not affect the price unless they were to form a cartel and control supply as is done in the oil industry. Considering the diversity and fragmentation of the farming industry, it is highly unlikely that farmers will ever take control over their industry. As such, farmers need to become more sophisticated in how they store, market and sell their crops.

Tools are now available to help farmers take back some degree of control over the marketing of their crops. On farm storage is the first step towards farmers being able to regulate the timing for selling their crops. By storing the grains and oil seeds in silos on farm, farmers can choose when to sell their crops to optimise the payments. However, farmers need measurement systems and data management software to work out the quality of their crops and to segregate and store the crops to optimise the value that lies in the protein and oil content of the crops.

This article discusses an on combine NIR analyser and software that allows farmers to measure the quality of their grains directly off the combine and then to manage the segregation and storage of the grains.

On Combine NIR Analysis

Near Infrared analysis is the technology that is used universally to measure protein, moisture and oil in grains and oil seeds. An on combine NIR analyser measures these parameters in grains and oil seeds in real-time as they are stripped from the field. Figure 1 shows the Sampling Head of the CropScan 3300H On Combine Analyser (Next Instruments, Sydney, Australia) mounted on the clean grain elevator of a CASE combine harvester. As grain passes up the clean grain elevator, a portion of the grain falls into the Sampling Head where it is trapped by a set of vanes. NIR light passes through the grain and is carried back to the NIR spectrometer located in the cabin via a fibre optic cable. The NIR spectrometer measures the amount of light absorbed by the protein, moisture and oil in the grains or oil seeds. The more light that is absorbed by each component, the higher the percent concentration.

When the grains have been measured, the sample is released into the downside of the clean grain elevator and is returned to the grain tank. Samples are measured every 7-12 seconds or around every 15meters down the row as the combine strips the grain. The protein, moisture and oil data are displayed on the Touch Screen PC mounted inside the cabin. Figures 2, 3 and 4 show three screen shots for the various options to display the data.
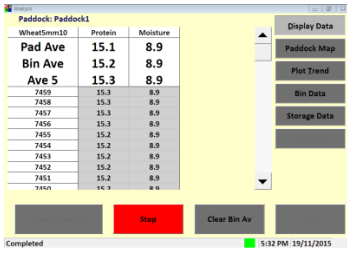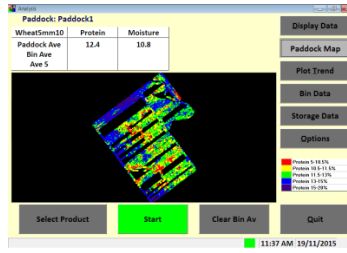
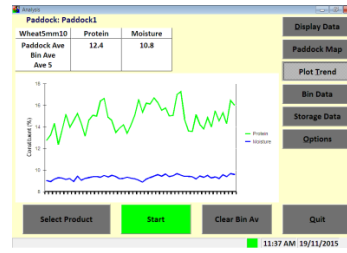Figure 2. Tabular Data   Figure 2. Field Protein Map   Figure 4. Trend Plots

The CropScan 3300H has been designed for use by farmers to segregate and blend grain in the field. The tabulated data shown in figure 2, provides the combine operator with a continuous stream of protein, moisture and oil results for each sample analysed. The Paddock Average, Bin Average and Running Average of 5 readings are displayed for all components. By clicking the Field Map button, the screen displays a real-time field map for protein, moisture or oil. Figure 3, shows an example of a protein map for a wheat field in Victoria, Australia. Another click takes the operator to the Trend Plots screen as shown in figure 4. These plots show the progressive results plotted as a time graph.

Recently, new features have been added to the CropScan 3300H software in order to control and direct the grains from the combine into chaser bins, field bins, trucks, silos and bags. Figure 5 shows the available storage bins and the running average of the grain placed in each storage system. Figure 6 shows a screen whereby the operator can select where the grain is being held and to select where the grain is to be stored. For example, grain in Chaser Bin CB1 is to be placed into Field Bin FB1. The running average for the components in FB1 will be upgraded when the contents of CB1 are placed into it.
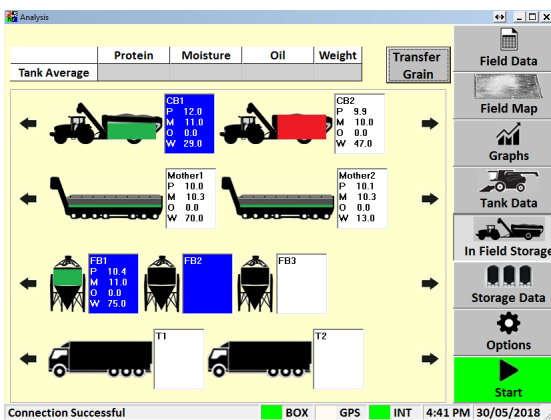

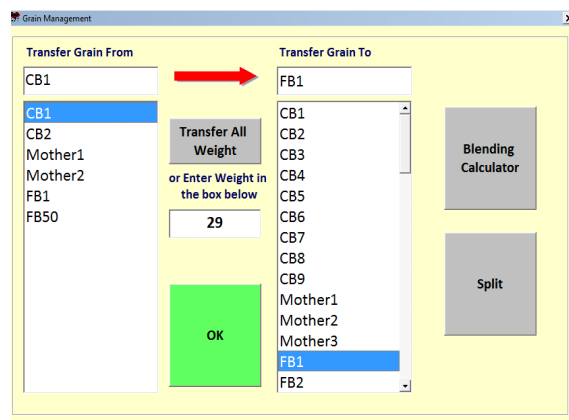Figure 5. Schematic of the Available Storage   Figure 6. Grain Transfer Screen.

The next new function is the Blending Estimator, figure 7. This screen allows the operator to automatically compute the result of blending grain from two or more storage systems into another silo. The sliders allow the operator to quickly adjust the tonnes of grain from each storage system that are to be placed into the collection storage system. For example, 29 tonne of wheat from CB1 with a protein content of 12% when blended with 70 tonne of wheat from the Mother Bin with protein content of 10% is placed into Field Bin2 would produce 99 tonne of wheat with an average protein content of 10.6%. In effect the ASW wheat from the Mother Bin was blended up to APW using grain from Chaser Bin1. The Blending Calculator is intended to take the guesswork out of in field blending.

Once the operator presses the OK button, the data is sent to the CropNet internet web site. From the CropNet web site, the farmer or anyone he provides access, can view the data using a Smart Phone, Tablet or PC. The data can then be downloaded to a PC running the CropNet Grain Data Management Software.

CropNet Grain Data Management Software

To complete the process, the CropNet Grain Data Management software provides a complete package to record and manage grain stored on farm. CropNet sets up a virtual on farm storage system that shows all the silos, bunkers, sheds etc that a farmer has on his farm. Once the data from the combine has been downloaded, it propagates the virtual storage locations as shown in figure 8. As grain is stored into each silo or storage system, the running average data for tonnage, protein, moisture, oil and other parameters are updated. By clicking onto a specific storage system then the running averages are shown on the PC, figure 9. The spreadsheet shows a record of every load of grain that has been stored in the specific storage system. Clicking the Graph button displays the Trend Plots for each parameter.
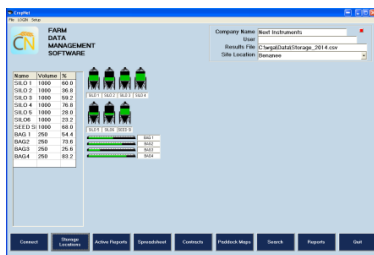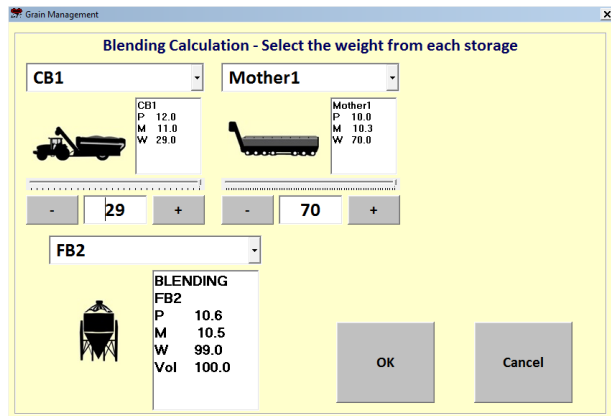

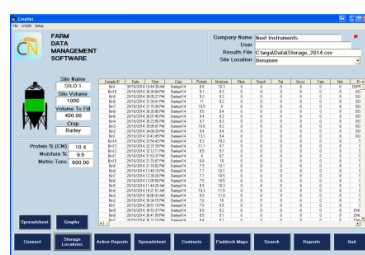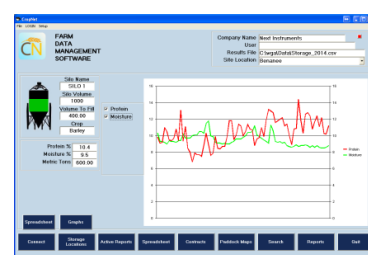Figure 8. Virtual On Farm Storage   Figure 9. Specific Storage System Data   Figure 10. Plots for Each Parameter

After harvest the CropNet Grain Data Management software provides the farmer with a means of managing the sale of their grain. Contracts can be listed and as grain is out loaded from the storage systems, the price and value of the grain is recorded, as well as the corrections to the running averages. The farmer can simply click onto any storage system and display the value of the grain stored in the system. By selecting each contract the farmer can see how much grain has been shipped, the price received and the income from the contract. The summary sheets show the total value for the grain stored on farm. Figure 11 shows the plot of the 25 x 40 tonne loads that were stored in silo 2.

Marketing Grain Off Farm.

A farmer in Euston, NSW, Australia, has used the CropScan 3300H for several years to manage his grain as it is stripped in the field. Mr Luke Follett crops wheat, vetch and barley on 8000 hectares and operate two CASE Model 8120 and 8320 combines. One combine is fitted with a CropScan 3300H. The combine operator uses the Protein Bin Average to direct the chaser bin driver to
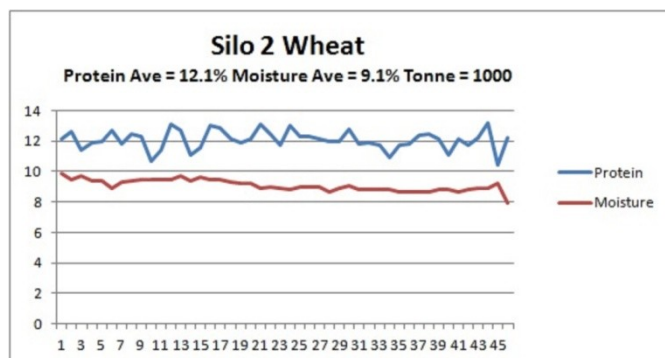
segregate the grain as it stripped. They segregate the grain into field bins and then load trucks to take the grain back to their 6 x 1000 tonne on farm silos, figure 11. The objective is to harvest the grain and store it in silos based on the grade, i.e., ASW, APW, H2 and H1 wheat as well as Malt Barley vs. Feed Barley. As the grains are being delivered to the silos, the data for each truck load is sent to the CropNet web site. The tonnage and running average for each silo is stored in the CropNet web site whereby it can be accessed by a Smart Phone, Tablet or PC.

Mr Follett uses the services of a broker, Fabian Devereux, Grainwise Pty Ltd, Mildura, Vic. Mr Devereux has access to the CropNet web site and uses the running average and the trend plots to market the Follett's grain directly from the silos. In 2016, Mr Devereux sold 1000 tonne of H2 grade wheat to a flour mill in Melbourne based on a premium of $5 per tonne as long as every load met a minimum of 12% protein. Mr Devereux provided the mill with the plot of the 25 truck loads that filled the H2 silo. They accepted every load as H2. As well, Mr Follett commented that they saved on rejected loads and deductions since they knew exactly what was being shipped rather than the guess work that had cost them thousands of dollars in penalties over the years.

A second example of using the CropScan 3300H to manage grain quality is a large farming operation in northern NSW. Beefwood is a property locate north of Moree in NSW. One of several properties owned by Topview Farming, Beefwood crops wheat, barley, peas and beans over 13000 hectares. They run 5 Claas 770 combines with two units fitted with the CropScan 3300H On Combine Analyser, figure 12. The farm manager, Glenn Coughran, has used a benchtop CropScan 1000B to make decisions as how to segregate and store their grain across the many fields and farms that make up the operation. In 2015 Mr Coughran installed two Cr3300H's so that they could make decisions on a load by load basis. Their operating procedure was to measure the protein of the grain in the field and then fill their trucks and record the average protein that made up each truck load. The driver would then be directed by Mr Coughran to take it to specific storage sites located around the large property. The objective is to grade the grain based on protein to meet specific contracts. Post harvest the grain would be shipped to the end users that have contracted Beefwood to supply grain.

Discussion:

Traditionally farmers have been price takers. The tools are now available for farmers to change their operations and to become price makers. The CropScan 3300H On Combine Analyser provides a means of measuring the quality of grains and oil seeds in real time based on protein and oil content and then directing the harvest operators to store grain on farm in order to optimise grade payments. The CropNet Grain Data Management software complements the CropScan 3300H by providing a web site to upload the data from the field and access it remotely from a Smart Phone, Tablet or PC.

Harvest is a very busy time of the year for farmers. It is when they make their living. For many farmers the simplest approach is to strip the grain and ship it to the local silo and take the best price they can get on the day. However by taking steps to measure the grain and then optimising the value of the grain based on protein can add significantly to farm income. Considering that all the costs of producing the grain are fixed by the time the grain is harvested, then the increase in the price of the grain will fall straight to the bottom line. $5-30 per tonne can be added to the farm income depending on the grade jumps that can be achieved by segregating and blending grain on farm.